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EDITORIAL.

The Complete Engineer of Three Hundred Years Ago.

Wrapped in the stoutest of manila paper and deposited on the shelves of the library of the American Society of Civil Engineers is a book, the gift of Mr. W. A. Haven, M. Am. Soc. C. E., which is probably one of the earliest of printed books in the English language treating of the art of science of engineering. On a curiously embellished title-page is the following caption:

A Practicall Abstract of the Arts of Fortification and Assailing. . . . Written for the benefit of such as delight in the Practise of those Noble Arts. By David Papillon Gent: . . . London Printed by R: Austin and are to be sould at the south side of the Exchange & In Popes head Alley 1645.

Engineering in that day, and for a century or so after, was entirely a military accomplishment, and so the science discussed by the author did not embrace any of the civil arts which later were a part of the engineer's knowledge, but prefacing the more serious work there is a chapter on "The True Character of a Complete Engineer" which will appeal even to the modern engineer. Especially will the last paragraph of this chapter touch a tender spot in the heart of every engineer who has had to argue against all reason with the lawyer, director or business man who can see in engineering only a superior sort of craftsmanship which, in its fundamentals, should be knowledge easily deduced by themselves. The major portions of this first chapter follow:

Of the True Character of a Complete Engineer.

1. He is to be religious; for the fear of the Lord is the beginning of wisdom.

2. He is to be a souldier; for none can better judge of the sufficiency or insufficiency of fortifications. . .

3. He is to be a traveller; for he that hath not seen variety of works, and the excellency of forreign Fortifications, cannot perceive the defects of ours, nor give directions to rectify them.

4. He is to be well versed in the Arithmetike for his calculations; in the Geometry, for the setting out of all superficies; in the Architecture, for to direct all manner of artificers; and in the other parts of the Mathematikes, for the taking of distances, depths and elevations, and for the inventing and contriving of all manner of Engines and machines of warre.

5. He is to be wise in all his proceedings, punctuall in all his promises, carefull and diligent in his calling, and rather enclined to austerity than lenity, or otherwise he will never be respected, served or obeyed.

6. He is to be of solid judgement and quick of apprehension to judge aright of the defects and advantages of places. . . He is not to give account of his actions to any, but to the Generall, or to the lieutenant Generall of the Ordnance; if he be in an Army, or in a Garison, only to the grand Committee, and to the Governour; and as for all other kinde of men, inhabitants, souldiers or officers; he is not bound to expostulate the case, if they demand of him reasons for any thing he directs or commands to be done; neither ought he if he regards his reputation, and makes conscience of his ways, to comply . . . with the humour of the greatest in authority, or be led to assent to any resolution, that is against the maxims of his Art, by the Logical and Sophisticall reasons and arguments of Scholars or Church-men; for some of them are now a dayes overbusie in things that go beyond their element, and endeavor to over-sway Artists by rhetorike, considering not that their reasons are no reasons at all to the reasons of art. And this last quality is the essentiall part of a good Engineer; for all the other are but to small purpose without this.

An Engineering Book to the Front.

An epoch in the history of engineering literature is recorded by a simple item from the day's news (italic ours).

The New York Public Library, circulation department, reports books most in demand, excluding fiction, for the week ending on Feb. 8, as follows:

Van Dyke's "Meaning of Pictures," Shelley's "Inns and Taverns of Old England," *Merriman's "Roofs and Bridges,"* Chesterton's "Orthodoxy," Ibsen's Plays, Shakespeare's Plays, Tarbell's "Life of Abraham Lincoln," Krehbiel's "Book of Operas," Finck's "Success in Music, and How it is Won," Huneker's "Egoists," Bryce's "American Commonwealth," Devine's "Social Forces," Penfield's "Present Day Egypt" and the Autobiography of Henry M. Stanley.—[N. Y. Eve. Sun, Feb. 10, 1910.]

REVIEWS.

Cost-Keeping and Management Engineering.

Reviewed by EMILE LOW,* M. Am. Soc. C. E.

COST KEEPING AND MANAGEMENT ENGINEERING. —A Treatise for Engineers, Contractors and Superintendents Engaged in the Management of Engineering Construction. By Halbert P. Gillette, M. Am. Soc. C. E., M. Am. Inst. M. E., Managing Editor of "Engineering-Contracting," and Richard T. Dana, M. Am. Soc. C. E., M. Am. Inst. M. E., Consulting Engineer. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 6 × 9¼ ins.; pp. 346; 184 illustrations in the text. $3.50, net.

In the early days of railroad building in the United States, the work, with rarely an exception, was divided into one-mile sections. Separate monthly reports of work performed were made for each section during the progress of the work and a final report at the completion of the same. These reports also showed the value of the work done at the contract prices and thus formed a record of quantities and values, which was generally known as the *estimate* and which has become a standard term for work performed, the same as the words, bill or statement for goods bought.

In addition to the information mentioned, the estimate also contained a statement called the *force account*, which was a monthly summary of all the various classes of labor employed by the contractor on the one-mile section which the estimate covered.

The rate of wages paid by the contractor being known, the total cost could be ascertained. The force account did not always contain every item of expense incurred by the contractor, but in a way served as a comparison, when compared with the value of work performed as returned by the engineer.

These early rude records were the forerunners of the more elaborate methods and systems described by Messrs. Gillette and Dana in the work before us.

The opening chapter deals with the effective management of men, which is outlined by means of ten laws pertaining to duties, supervision, performance, reward and conduct. This chapter contains much valuable advice as to methods for promoting the efficiency of workmen by proper assignment of duties; by rules for the conduct of work, as in the instance of rules for "Railway Location;" by daily reports of work done; and last, but not least, securing discipline by the proper dignity of superiors.

Rules for securing minimum cost, 17 in number, are formulated in Chap. II. Some of these rules are that the sum of the items of unit cost must be a minimum; every element of a plant must be worked to its capacity; reduce the cost of attendance of machines; transport and handle materials in groups; use low-priced men to do mere manual labor; instal suitable plant; design work in the office, instead of leaving this to the ingenuity of workmen, to be done in the field.

Chapter III. treats of payment for work done and considers some of the various methods that aim to recompense a workman in proportion to his performance. These include profit-sharing piece-rate system, bonus system, differential piece-rate system, premium plan and the "stint" system.

Methods to measure the output of workmen are treated in Chap. IV. The authors tersely say:

Before men can be paid according to their performance it obviously is necessary to devise methods of measuring the number of units of work done, but it is not always so obvious what units to select nor how to measure them readily after the selection has been made.

In rock excavation, it is recommended that the linear foot of drill hole be taken as a unit of work in measuring the output of drillers and not the cubic yard. Other units are the cubic yard for excavation and concrete; 1,000 ft. B. M. for form work; the linear foot for tracklaying, fence building, pipe laying and setting curb; the square yard, square foot or "square" for paving, painting, roofing and plastering.

Reference is also made to the use of functional units of measure. Having a record of the amount of cement used each day, a close approximation of the number of cubic yards of concrete can be obtained for a given mixture.

Upon the ingenuity of the management engineer who devises ways of recording the daily output of work done rests the success or failure of any effort to introduce modern methods of management on complicated contract work.

The four chapters already mentioned occupy 63 pages, ranging from 13 to 18 pages each. They relate primarily to engineering management and methods to obtain a minimum cost of engineering construction.

The remaining three chapters are more extensive, Chapter V., cost keeping, contains 46 pages; Chapter VI., office appliances and methods, 17 pages; Chapter VII., bookkeeping for small contractors, 23 pages; Chapter VIII., miscellaneous cost report blanks and systems of cost keeping, 190 pages.

The authors state that the two primary objects of cost keeping are:

(1) To enable a manager to analyze unit costs with a view to securing the minimum cost possible of attainment under existing conditions.
(2) To provide data upon which to base estimates of the probable cost of projected work.

It is interesting to compare these statements with that found on page 169 of the annual report of the Isthmian Canal Commission for 1909, entitled "Cost-Keeping":

Cost-keeping proper is necessary for two reasons, for the canal work, as well as in general for any construction work: (1) As a part of the permanent record of work and expenditures, thus forming a part of its history, and as a guide for any similar work in the future. (2) As an indication of the efficiency with, which work is being carried on, so that any change in methods or organization may be made to secure greater economy and efficiency where same is considered necessary. It also enables a comparison being made of the cost of work between any two periods and also between any two divisions performing similar work.

Considerable space is devoted to show that cost-keeping is a thing entirely different from bookkeeping, this latter evolved by merchants, a system of debits and credits, while cost-keeping, evolved by engineers, is a system for showing the efficiency of workmen and machines. Stress is

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also laid on the difference between cost-keeping systems for manufacturers and for constructing engineers.

Time-keeping is defined and illustrations of a large number of written and punch-card reports are shown, copies of requisition slips are given and blanks for reporting supplies received are also shown. In addition, several charts are shown, both cost and progress. As is well known, diagrams are very satisfactory methods to show relative performance or relative unit costs.

Chapter VI. explains office appliances and methods, which include time clocks, time stamps, mimeographs, counters, adding and multiplying machines, slide rules, planimeters and wage tables. Notes for systemizing a contractor's office are also given, being mainly the experience of Mr. Frank B. Gilbreth.

Bookkeeping for small contractors is treated at great length in Chapter VII. Various blank forms are shown, including some for recording fundamental divisions of cost, besides blanks for payrolls and distribution sheets of expenditures, labor and materials.

Miscellaneous cost-report blanks and systems of cost-keeping make up Chapter VIII., which comprises more than half the volume. Over 150 blank forms of all kinds are shown, many of which are forms used by such well-known contracting firms as: The Moore-Mansfield Construction Co., Aberthaw Construction Co., and P. F. Brendlinger.

An examination of the *personnel* of many contracting firms of the present day will develop the information that their management is in the hands of trained engineers. The financial success of these firms is no doubt greatly due to the fact that all operations are conducted on knowledge based on studied conditions, rather than on guesswork or "cut and try" methods.

A fact not generally known is that the State Engineer of New York is compelled by law to fix the prices of each and every item of work entering into the contracts for the construction of the so-called Barge Canal, and when the bids exceed by more than 10% the gross cost of the work as estimated by the State Engineer or more than 20% the cost of any item, the contract cannot be awarded unless such award shall be approved by the State Engineer and the Canal Board. This requirement presumes a knowledge on the part of the State Engineer of the cost of various classes of work, and this is a cogent argument in favor of cost records and data, as erroneous assumptions of unit prices would prevent letting of contracts and thus hold up work awaiting readjustment of unit prices for a new letting.

The subject matter treated in the book is one which is attracting considerable attention, and, owing to the admirable manner in which it is presented, the book is to be commended. Engineers, contractors and superintendents engaged in engineering construction can profit much by its perusal.

Some of the Data of Air and Health.

AIR AND HEALTH.—By Ronald Campbell Macfie, M. A., Author of "The Romance of Medicine," etc. New York: E. P. Dutton & Co. Cloth; 5½ x 9 ins.; pp. 345. $2.50.

There is here brought together a large amount of information which can be used in considering the relation of air and its various aspects to the health of human beings. The author begins with a general discussion of the atmosphere and continues with notes on the chemical composition of pure air. He then takes up in succession respiration, air pressure, temperature, humidity and solar radiation. Then follow some chapters which relate more directly to health, although to a large extent they also are composed of data rather than conclusions. These chapters deal with impure air in general, air polluted with smoke, fog, mining gases, sewer emanations, etc.; dust and germs; and ventilation. The author then returns to respiration and takes up chest breathing. He next considers artificial atmospheres, then deals with climate and the discovery and properties of the gases of the atmosphere. He concludes with a chapter on the open-air treatment of consumption, and open-air schools.

The subject matter is presented, on the whole, in a very readable manner, and will be useful to those who wish to have, for reference purposes, the many details which the author sets forth. The practical suggestions on the relation between air and health may also be helpful to many.

Structural Paints.

Reviewed by ROBERT JOB.*

PAINTS FOR STEEL STRUCTURES.—By Houston Lowe. Fifth edition, revised. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5 x 7½ ins.; pp. 115. $1; English price, 4s. 6d., net.

This work gives a summary of a number of generally accepted theories and facts connected with paint, its application and properties. The author mentions the recently-developed electrolytic theory, and gives a partial list of pigments which are thought to be inhibitors of corrosion, and some which are considered stimulators. This theory may well be of the greatest importance in the valuation of pigments for structural work, and although it is now too soon to state authoritatively the relative merits of the pigments from this standpoint, there is every reason to believe that within a comparatively short time definite data will be obtained as a result of the work of the Paint Manufacturers' Association upon the test fences at Atlantic City and at Pittsburg.

Mention is made of the cause of the inferior results often obtained from the paint applied to steel cars by car manufacturers due to thinning of the paint with benzine or various grades of mineral oil. In the writer's experience this condition has been all too prevalent. New steel cars have been seen which in six months' time under ordinary conditions of service were in urgent need of repainting owing to the admixture by the car manufacturers of these inferior oils to paint which otherwise would have given good service. Additions of this character of course are adulterations, and the only effective remedy for dishonest practice is a rigid inspection during the construction of the cars.

On page 85 a statement is made which does not accord with the experience of the reviewer. The author says that "natural ores or mineral earths seldom yield pigments that are good for making metal coatings for the reason that they contain more or less water," etc. It is a fact that one of the most satisfactory structural coatings which has come under the observation of the reviewer has been a pigment of this nature containing about 12% of combined water.

Upon page 99 the author makes the rather startling assertion that Chemistry cannot at all predict what paint will do in service, but fortunately for the consumer this statement is flatly contradicted by general experience, and many large corporations have for years been able by means of careful chemical control of shipments to ensure both durable and efficient service of their paint supplies.

The book contains much information which will be of service to the practical painter.

THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.—Transactions, December, 1907, Vol. I., No. 1. With business records. (L. W. Chase, Secy., Lincoln, Neb.) Paper; 6 x 9 ins.; pp. 102.

Though this report seems to be much belated, we take pleasure in giving it a little more notice than merely listing it under "Publications Received." The society in question promises to be very useful and well worthy of inclusion in the list of important technical societies of the country, as may be judged by the report of its third annual convention, published in Engineering News for Jan. 6, 1910. The report before us contains much that is in the nature of a general survey of the field, as might be expected at an initial meeting. Among the subjects treated are lecture and shop courses in agricultural engineering, and research work in the same subject. The literature of agricultural engineering is also briefly considered.

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Against Waterways.

THE AMERICAN TRANSPORTATION PROBLEM.—Study of American Ttransportation Conditions, with a View to Ascertaining What Policy America Should Adopt in order to Effectively Meet Existing Conditions and Be Prepared to Continue to Lead the Nations in the March of Progress and Civilization. By John Howe Peyton, M. Am. Soc. C. E. Louisville, Ky.: The Courier-Journal Job Printing Co. Paper; 6 x 9 ins.; pp. 311; two folding plates and numerous text illustrations. 50 cts.

Probably we can give our readers the best idea of the character of this book by referring them to the extended extract from one of its chapters which we have printed on page 188 of this issue. As will be seen by that extract, the object of the author is to show the superior economy of the railway as a means of transportation over inland waterways, either artificial canals or improved rivers.

Mr. Peyton takes up in detail a considerable number of schemes for inland waterway improvement on which millions have been expended by the Federal Government and shows that the traffic using these waterways is in every case so small that the investment of public funds has been practically wasted. Of course the waterway advocates claim that the railways are responsible for diverting traffic from the waterways by making lower rates where waterway competition must be met. Mr. Peyton, however, shows that the real reason why the waterways have been abandoned is not unfair competition on the part of the railways but the actual superiority of the railway as a transportation machine under American conditions.

As a contribution to the study of transportation economics, the book is a most valuable one. It is to be regretted, however, that the author's zeal has led him to attack the motives of the waterway agitators and to employ lurid language in his discussion of recent legislation for railway control. We are far from agreement with the author's position in this particular; and we fear that the influence of his book will be greatly impaired by the adjectives he applies to those who differ from him. For our part, we believe the waterway advocates are honest and sincere, for the most part; and the men in public life who have supported the waterway measures are by no means the demagogues that Mr. Peyton claims.

What is needed is temperate discussion and public education as to the facts. The violent tone of much of Mr. Peyton's pamphlet will cause many to set him down as an inspired agent of the railway interests. We believe such an estimate is as incorrect as his own estimate of the motives animating those men in public life who are zealously carrying on the campaign for waterway improvements.

Another Book On Aerial Flight.

THE CONQUEST OF THE AIR.—Or the Advent of Aerial Navigation. By A. Lawrence Rotch, Author of "Sounding the Ocean of Air," Professor of Meteorology in Harvard University, etc. New York: Moffat, Yard & Co. Cloth; 4¾ x 7½ ins.; pp. 192; 36 illustrations, mostly in the text. $1, net.

In a handy little book, easily read by non-scientific folks, Prof. Rotch has reviewed the "conquest of the air." To those who are already familiar with the advances of this art and science, naturally, the book can present nothing new, except the author's viewpoint as a meteorologist. His interest in the study of the atmosphere is disclosed in a long introductory chapter, "The Ocean of Air." In this section, present knowledge of the variations of winds and temperatures at different altitudes, and of allied topics, is summarized.

The history of ballooning and the development of dirigible balloons and aeroplanes are interestingly related. To reduce this long story to a few small pages, details in general have been sacrificed.

In the final chapter, the author puts forward a few cautious prophecies as to the field of usefulness of aeroplanes, in times of peace and of war, and also suggests the improvements necessary to further perfect the flying machine.

It is an interesting commentary, on the rapidity of progress in aviation, to note that, before the author's statement in reviewing re-

cent progress that "not one has yet risen 1,000 ft. nor dared to venture over cities or seas" had seen print, it because obsolete and misleading. It will be remembered that Orville Wright reached a height of 1,600 ft. at Potsdam, Germany, on Oct. 2, 1909, and two days later his brother made a 20-mile flight over New York Harbor and up the Hudson River. Hubert Latham rose 3,600 ft. with an Antoinette monoplane flyer on Jan. 7, 1910, at Mourmelon, France, but he was outdone by Louis Paulhan at Los Angeles, Cal., on Jan. 12, by a flight with a Farman biplane, rising 5,000 ft.

The Gas Engine.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

THE MODERN GAS-ENGINE AND THE GAS-PRODUCER.—By A. M. Levin, M. Am. Soc. M. E., Consulting Engineer. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 485; 181 illustrations in the text and 35 tables. $4; English price, 17s., net.

Mr. Levin has made an interesting contribution to gas-engine literature. He starts out along an independent path, uninfluenced apparently by the usual methods of developing and expounding his subject, and has produced a book which shows considerable originality in method of presentation and a good grasp of his subject both on the theoretical and the practical sides. The main matter of the book he says,

> consisted originally of a collection of notes arranged with the idea of presenting, for personal use, as clearly and as directly as possible any of the numerous questions pertaining to the gas-engine that, in practice, often come up and require immediate answers.

The opening chapter is an introduction to thermodynamics. The originality of the author has led him somewhat astray in minor points here and elsewhere. It is usually unfortunate to tamper with the methods of expressing fundamental conceptions, unless one has a very deep knowledge of the subject; it is also unsafe to attempt new definitions of fundamental terms without that equipment. An example of the troubles into which the author falls occurs on page 1, where he says:

> The fundamental relations between the variables of thermodynamics are two, of which the first may be expressed as follows:
> "The internal heat of every substance depends exclusively on its pressure and volume."

Omitting any comment on his "variables of thermodynamics" it may be pointed out that his statement is quite misleading. In a perfect gas the "internal heat" is a function of temperature, only, and does not vary with pressure and volume. The temperature is a function of the pressure and volume so that his statement is not incorrect, but it is entirely misleading to the student. Numerous similar faults may be found throughout the chapter.

In the second chapter is laid the foundation for the development of formulas which permit the determination of the actual thermodynamic efficiency of a gas engine and of the actual work done. This is accomplished by the use of various factors. One of these, f, he defines as "the ratio between the heat theoretically absorbed by the working gases and the total heat supplied in the normal charge." That definition will probably not convey much meaning to the reader; an examination of the context suggests that the factor, f, is the ratio of the heat actually developed during combustion to that which would be developed by complete combustion. The quantity fQ, he defines as "the heating value (*sic*) absorbed by the working gases at the time of combustion" where Q is the "heating value supplied per pound of normal charge." Another important factor is y which appears to be the ratio of the actual efficiency to the theoretical efficiency of the cycle, both being based on the actual heat generated during combustion. (A few pages after its introduction y is defined as "a correction factor for the heat that has been gained or lost during the practical cycle." This seems designed to puzzle the reviewer and others.) The work done in any actual engine is represented by $JEfyQ$ where J is the mechanical equivalent and E is the theoretical efficiency of the cycle as defined above.

The principal object of the first part of the book is the determinations of the values of the various factors in the above expression for the work done. The theoretical efficiencies, E, of the more common cycles are developed in the usual way. The determination of Q involves a number of considerations including a knowledge of characteristics of the various fuels and a determination of the weight of the charge that is taken into the cylinder. To find the weight of the charge it is necessary to know the pressure and temperature existing in the cylinder at the end of the admission, and also the temperature of the residual clearance gases. The author goes into somewhat elaborate calculations as to the temperature at the end of admission taking into account (1) the adiabatic fall of temperature during admission due to the pressure reduction in the cylinder, (2) the heating effect of the cylinder barrel, combustion chamber, piston and exhaust valve; and (3) the effect of the clearance gases. These calculations demand numerous assumptions as to temperatures and rates of heat exchange. He finds a maximum temperature of 120° F. at the end of admission when the exhaust valve and piston are not cooled and the clearance is large; and a minimum temperature of about 80° F. when these conditions are reversed.

Assuming the pressure at the end of admission to be 1½ lbs. below atmospheric pressure, and assuming values for fy he is then able to calculate the piston displacement per horse-power for various fuels.

This method of attacking gas-engine theory is interesting but it is not convincing; it is based on a number of assumptions which in turn have as their justification the results of gas engine experience or tests. It is more straightforward and is less misleading to use as a basis for gas-engine design, the diagram factors, mean effective pressures, and efficiencies that have been found by tests on existing engines. The method adopted here does not give a more trustworthy guide to design but it is likely to give to the unconsidering a feeling of greater security than the conditions justify.

The discussion of fuels which is interwoven with the treatment of gas-engine design is on the whole, illuminating, but there are numerous unnecessary obstacles to the student. The following statement cannot be accepted:

> In a saturated mixture of a fuel gas and air, which may be assumed to follow the laws of perfect gases, the ratio of the weights of vapor and of air present in a given volume equals the direct ratio of their respective vapor pressures.

If the author had written out the gas equation he would have seen that the pressures are proportional to the product of the weights by the gas constants. And why does he speak of the vapor pressure of a gas?

Among other anomalies of nomenclature attention may be called to "Carbureted Gasoline" and "Carbureted Kerosene."

Alcohol is treated in some detail, but certain errors have crept into the statements as to heats of combustion. It is curious that the statements in a number of recent text books as to the heat of combustion of the alcohols are quite wild. In this book ethyl alcohol is given a calorific power of 16,000 B. T. U., and methyl alcohol 13,000 B. T. U.; no statement being made as to whether these are high or low values. Extraordinary variety exists in different books, the quantity varying from 20,000 B. T. U., to about 11,000 B. T. U. for the heat of combustion of ethyl alcohol. The best authorities are likely to be found in Landolt and Börnstein's "Physikalisch-Chemische Tabellen." Two values are given there by two investigators, Thomsen and Berthelot; these values reduced to English units average a little over 13,000 B. T. U. for ethyl alcohol, and about 10,000 B. T. U. for methyl alcohol—both high values. The Smithsonian Physical Tables give Favre and Silberman's determinations, 12,929 B. T. U. for ethyl alcohol, 9,553 B. T. U. for methyl alcohol, both high values. In the present work there are glaring inconsistencies in the alcohol calorific values—denatured alcohol with 80% by weight of ethyl alcohol, and 9% by weight of methyl is given a higher "heating value" of 11,880 B. T. U. by test, whereas, if calculated from the values given in this book for the heats of combustion of the two constituents, the calorific value of denatured alcohol would be about 14,000 B. T. U.

Recent tests by the U. S. Geological Survey have shown that with proper compression an alcohol engine will use no more fuel than a gasoline engine. This differs considerably from the statement in the book that an alcohol engine requires 50% greater weight of fuel than a gasoline engine.

On page 157 occurs the formula $d.v = \frac{x}{B-x}$, from which is deduced $x = \frac{B}{1+d.v}$ and the inaccurate deduction is immediately utilized. On page 158 and elsewhere, the term "critical temperature" is used where saturation temperature is meant, ignoring entirely the proper and usual meaning of "critical temperature."

After the discussion of fuels is a chapter on some of the phenomena occuring in gas engines, principally explosion phenomena. The ignition temperature of various mixtures, it is stated, is not generally changed by diluting the mixture. This dictum is hardly supported by the more recent investigations of Falk and others which show considerable influence of dilution either by neutrals or by one of the active constituents. Similarly, the experiments of Grover are quoted as showing that the presence of neutrals increases the rapidity of combustion although it has been shown both by Wimperis and by Dugald Clerk in their recent books, that these results arose from errors in Grover's experimental work; moreover, the everyday experience of gas engineers shows the incorrectness of those researches.

The middle section of the book deals with the design of parts of the engine. The fly wheel is first considered. The coefficient of "fluctuation of energy" is determined from some fifteen types of engine and examples are given of the methods for determining weight and diameter of the fly wheel for various sizes and types of engines, direct connected to alternating current generators; this is usefully and suggestively done. The crank shaft is dealt with next, particularly the center crank type, and is also handled well. The other parts are less exhaustively treated, but tables of dimensions are given for many of them. The chapter devoted to governing is well done; some revision is necessary in Figs. 112 and 115, which seem to show that with variable quantity regulation the exhaust back pressure varies with the load.

The detailed description of special engines is done very thoroughly with adequate illustrations. The Koerting two-cycle engine occupies 10 pages, which is not too much; but it is hardly worth while to devote 9 pages to the Oechelhauser engine, which is no longer being made, although a number of them are still operating in Germany and a few in England.

The final chapter is on producer-gas and gas-producers. It is not as thoroughly handled as the engine part but it is by no means inadequately treated and is suggestive from both the theoretical and the practical standpoints. The use of exhaust gas from the engine instead of steam is fully discussed in its relation to thermal efficiency, but its practical effects in causing clinkering and in permitting higher compression are not touched upon. An appendix gives details of some important gas-engine tests.

On the whole, the book has much to recommend it; it was worth writing. Such books as these, by practicing engineers, who presumably have had little experience in writing, ought to be gone over by men with more literary experience before they are issued. A phrase such as "a book designed to be of use to others in like situations as that of the author" should discredit the proof-reader and the publisher rather than the author. It is of advantage to the publisher, and it should be regarded as his duty, to see that obscurities of syntax are removed. The principal function of the author of a technical treatise is to supply the subject matter; if he can put it in good literary form so much the better; if he fails to do so it should be easy to revise his work.

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Waterway and Railway Transportation.

AMERICAN INLAND WATERWAYS.—Their Relation to Railway Transportation and to the National Welfare; Their Creation, Restoration and Maintenance. By Herbert Quick. New York and London: G. P. Putnam's Sons. Cloth; 6¼ x 9¾ ins.; pp. 241; 81 plates. $3.50.

The current agitation over waterway improvement is being taken advantage of by enterprising publishers who are offering books on the subject. It is obvious that a really good, reliable and authoritative work on this public question is much needed at the present time; but it ought to be also obvious that any such work ought to be prepared by some one with sufficient expert knowledge to discern the true from the false.

The author of this book states in his preface that he is not an engineer, but that "every statement of engineering doctrine in the book has been scanned by competent specialists." One wishes that the names of these "competent specialists" had been given or at least some statement of their competency to qualify as experts in transportation economics.

However, the book bears evidence that its author has made an honest effort to get at the truth. In some of his chapters he has been successful in presenting well certain aspects of the waterways problem to which comparatively little attention has been paid, and which shed much light on the subject in controversy.

The titles of the chapters give an idea of the scope of the book, and we therefore reprint them as follows:

1, The Grand Strategy of Trade; 2, Bringing the Sea to the Farms; 3, The Railways and the Waterways; 4, Terminals a Vital but Neglected Matter; 5, The Rivers and the "Conservation Movement"; 6, The Long Look Forward in Transportation; 7, The Battle of the Engineers.

His chapter on "The Grand Strategy of Trade" may be summarized as an argument that the country as a whole must have its railway transportation facilities supplemented by waterways in order to compete with other industrial nations. The author assumes that because the industrial nations of Continental Europe are spending large sums in waterway improvement, it is necessary for the United States to do the same.

The chapter entitled "Bringing the Sea to the Farms" is a review of the various projects for deep waterways from the Lakes to the Atlantic and to the Gulf. Some idea of the author's grasp of engineering may be gained from his statement that: "the highest estimate I have ever seen for a 30-ft. channel from the Gulf to the Lakes is $345,000,000, and this must be fully 50% over the mark." It is perhaps unnecessary to say to our readers that no real *estimate* of the cost of such a channel has ever been made. It would require a huge expenditure in surveys and plans before any such estimate could be made. What Mr. Quick is referring to is not an estimate, but a *guess*; and guesses by amateurs who have no conception at all of the problems involved are a wholly unsafe basis on which to frame any public policy.

In Chapter III., "The Railways and the Waterways," the author reveals the fallacy which underlies his whole discussion. This fallacy he sets forth as follows:

> The breakdown of the railways comes from the fact that they are groaning under the bulky, heavy, cheap freight that under the German and French system will go by water, leaving the high-grade stuff, which can pay a high rate, to go by rail. The railways which have the blessing of waterway competition are relieved of the burden of carrying this cheap freight, which uses so much equipment and pays so little.

It is not strange that Mr. Quick should have been misled on this point, for the theory that the railways lose money in hauling low-grade freight, and would be better off if they could turn it over to waterways, has been repeated over and over again by the newspaper engineers who are leading the country in this waterway campaign.

The fact is, however, as every real expert in modern railway transportation knows, that the railways of the United States make their largest profits on the haul of bulk freights. It is true that the railway rates on coal, ore, grain and similar standard commodities which are handled by the train-load are very low. But the cost to the railways of handling such business is so small, compared with the cost of handling the high-class freight, and the volume of the business is so great, that it is this low-grade bulk traffic which is to-day actually earning most of the profits of American railways. If Mr. Quick, or any other serious and fair-minded student of the problem, will study a later chapter in this very book, entitled "Terminals a Vital but Neglected Matter," the fallacy which we have pointed out will be evident.

This chapter on terminals deserves high commendation. Mr. Quick is entirely right in his conclusion that the matter of terminal facilities and cost of handling in terminals is the determining factor in economic transportation. It is exactly because the railway can usually handle bulk freights at a far less terminal cost than the waterway, that the final cost from producer to consumer *under United States conditions* is actually less, in most cases, by rail than by water.

Of course there are exceptions to this rule, as for example, the traffic on the Great Lakes and on the ocean, where it often happens that shipments by water can be handled with a smaller terminal charge than would be necessary on shipments by rail. But it will not do to apply the results obtained in deep water transportation to the inland channels which Mr. Quick discusses in this book. Mr. Quick himself shows plainly that before inland waterways can compete with the railways, they must have proper water terminals. He says, on page 125:

> If the Ohio River towns had done as much for themselves as the Government has done for them, every village would have its public dock, every dock would have its warehouse, and every warehouse would have its machinery for transshipment, loading and unloading.

This sounds very fine, but when Mr. Quick has added to the present cost of water transportation on the Mississippi and its tributaries, the cost represented by an investment in terminals all along the river suitable to economically handle traffic at all the different stages of a stream which varies 30 to 50 ft. between the high and low water—when he has added all this, where, then, will be his claimed economy of water transportation over rail?

Chapter V. is devoted to a review of the conservation movement, together with the plans originating with Mr. Marshall O. Leighton for supplementing the slack-water navigation system on the Ohio and its tributaries by the reservoir system. He also discusses the matter of the government control of water-power and the agitation for forest preservation in the Appalachians. The same subject is resumed in his concluding chapter, which he entitles "The Battle of the Engineers," and which is an attempt to make clear to the lay reader the discussion which took place in Engineering News and the "Proceedings" of the American Society of Civil Engineers, a year or more ago, with reference to questions of river improvement, reservoir control, and the effect of forestry on rainfall and run-off.

After presenting his abstract, Mr. Quick remarks: "Out of all this wealth of argument and poverty of conclusion, the lay mind emerges in some bewilderment." Mr. Quick takes refuge from this bewilderment by adopting the conclusion of a Wisconsin lumberman, whom he quotes as saying: "Why, a man doesn't need any learning to know that forests protect the hills from washing, and regulate the flow of streams; all he needs is common sense."

The author's chapter entitled "The Long Look Forward in Transportation" is a review of what he apparently advocates as an ideal in the way of inland waterway improvement from the Atlantic to the Pacific. The ideality of his view is indicated by a sentence near the close of the chapter, in which he says: "Save in exceptional cases, every town in the land will have its waterway to the sea." We refer the author to any map of the United States showing the region between the Missouri and the Pacific and the abundant scarcity of water therein. If the public is to be led by expert advice of this sort in the development of its public works, national bankruptcy is not far ahead.

We may add that the publisher's work has been well done, so far as the production of large, finely illustrated and finely printed books is concerned. On the other hand, all the matter in the book could have been presented equally well in a volume of a half or a third the weight and thickness—a volume which could have been marketed for a price much more in keeping with the character of a book like this, than the "*de luxe*" edition which has been here produced.

SEWAGE PURIFICATION WITH SPECIAL REFERENCE TO WISCONSIN CONDITIONS.—By George Jacob Davis, Jr., Assistant Professor of Hydraulic Engineering, University of Wisconsin, and James Ten Broeck Bowles, Ph. C., Sanitary Chemist, State Hygienic Laboratory. Bulletin of the University of Wisconsin, No. 331. Madison, Wis.: The University. Paper; 6 x 9¼ ins.; pp. 87; 18 figures in the text. 30 cts.

A number of the state universities of the Central West are doing good service by issuing bulletins designed to make available in a compact and readily understandable form information on technical subjects of vital importance to a considerable number of citizens. The bulletin before us is an attempt to outline briefly the present status of sewage treatment as regards methods, design and operation. A few sewage purification plants in the state are described and illustrated. In addition there is a table entitled "The Sewerage of Wisconsin Cities and Institutions." This table gives population, body of water receiving sewage, and method of purification if any. It appears that there are about 20 municipal and institutional treatment plants in operation, and that plans for a half-dozen more have been approved by the State Board of Health. Tabular and other information is given regarding four sewage works, under the general heading "Investigation of Wisconsin Plants."

The authors have presented a novelty in filter classification by defining percolating and trickling filters as something quite distinct. Apparently they mean to include the old-style intermittent sand filters and the like under the head of percolating filters, and to class as trickling filters what have heretofore been indiscriminately called either by that name or percolating filters. It is not plain whether the authors intend to institute a new classification, or whether they have been led to this definition by a misunderstanding of well-accepted nomenclature and description. One would not suppose, however, that a new nomenclature would be introduced without explanation.

Under the heading "Septic Tanks" there seems to be undoubted confusion of ideas, for after referring to the use of this term by Donald Cameron the authors say:

> The term is commonly used now for tanks in which it is intended that septic action should occur, regardless as to whether that action is caused by aerobic or anaerobic bacteria.

Elsewhere the authors refer to the action in the septic tank as anaerobic, which is, of course, correct.

It seems unfortunate that in a bulletin issued by a state university for educational purposes, there should be any such confusion as is shown by the statements regarding filters and septic tanks.

MANUAL OF ACCOUNTING AND BUSINESS PROCEDURE OF THE CITY OF NEW YORK.—Issued by the Department of Finance. Herman A. Metz, Comptroller. New York: Pub. Doc. Cloth; 8 x 10¾ ins.; pp. xxxvi. + 552; folding plates and text illustrations.

We have here a remarkable publication for a city document—some 500 pages of detailed accounting procedure for the city of New York. The importance of correct accounting procedure may be the better appreciated when it is stated that the Department of Finance is responsible for the accounting of 100 city departments and offices, involving altogether some 60,000 employees. Until recently, city accounting in New York can scarcely be said to have been conducted in accordance with any system. Reforms have been made possible by the cooperation of Comptroller Metz and the Bureau of Municipal Research, although the volume before us makes no mention of the Bureau. The accounting procedure outlined here in great detail starts with

a document for each and every city transaction subject to accounting control. It then proceeds through the various registers up to the final summaries for the city as a whole. The aim of the system is to attain such simplicity in forms and books of account that any intelligent clerk can do all the entry work except that pertaining to the general ledgers of each department. Experts in accounting are required for these.

The whole object of the accounting system, as outlined, is to provide for control of the financial operations of the city. Such control falls under three heads: Administrative, relating to the general and detail features of the business of the city; executive control, or the direction of affairs to secure conformity to established policy and to check administrative efficiency; and finally popular control, or so presenting financial transactions that intelligent voters of the city can judge for themselves the efficiency of their city government. As an intermediary between the voter and the official stands the Bureau of Municipal Investigation and Statistics, the function of which is to digest various public records and put them in shape for publication in the "City Record," which is the official organ of the city of New York.

The volume contains sample accounting heads and other diagrams, which, with the text, serve well to show just what is proposed by this accounting system. The volume as a whole is well worthy of study by responsible accounting officials of other cities and by all who are interested in much-needed reforms in city accounting throughout the country.

Overhead Electric Transmission-Line Crossings.

Reviewed by C. T. WILKINSON,* Assoc. Inst. E. E.

THE PROTECTION OF RAILROADS FROM OVERHEAD TRANSMISSION-LINE CROSSINGS.—By Frank F. Fowle, Consulting Electrical Engineer. New York: D. Van Nostrand Co. Cloth; 5¼ × 7¾ ins.; pp. 69; 35 illustrations, mostly in the text. $1.50, net.

This book consists largely of a paper prepared for the 27th annual convention of the Association of Railroad Telegraph Superintendents, held at Montreal in 1908, but owing principally to the fact that the subject matter was not completed in time for presentation at the 1908 annual meeting it is now published in book form.

The author discusses the protection of life and property of railroads, and the dangers and effects of the failure of a high-tension transmission line at a railroad crossing. He gives examples of high-tension practice in line construction, and illustrations of failures in high-tension lines and of screen protection. He also takes up bridge and catenary types of reinforced crossings, and underground crossings. Final conclusions are given under the heading, "Discussion of Proposed Type of Crossings."

The present chaotic condition of practice with regard to the subject dealt with by the author is more than sufficient excuse for the presentation of this book, and though some engineers may not be in entire accordance with all the statements made, the book is nevertheless of considerable interest as representing the author's experience. Although only some 70 pages long, the book contains no fewer than 35 illustrations; among which possibly the most interesting are those showing the results of failures of wood pole lines due to electrical causes, such as burning of the wood due to arc-overs or as the result of broken insulators. Interesting details are given of the methods now adopted and their relative cost.

The chief interest of the book, of course, settles on the author's "Discussion of Proposed Type of Construction," in which he advocates greater conservatism than has been used by some transmission companies in the past. A sleet load on wires of 1-in. diameter is recommended as a minimum safe requirement. It is of interest to note that the author sees no reason to believe the statement that sleet does not deposit on conductors due to high voltage (up to 33,000 volts) or to normal operating current; and further that he can find no reason to recommend any difference in the sleet allowances for copper and aluminum. An interesting discussion is given on the question of factors of safety. It appears that the author's recommendations may be summed up as: "ample factors of safety in electrical and mechanical design." Many points mentioned would have lead to a most interesting discussion if presented at a society meeting.

The reviewer notices with regret that the author makes no mention of the standard method of protection of railroad crossings summed up by the special engineering commission of the New York Central Railroad Co. in its report made early in 1908, which has led to the standard specifications of the railroad named.

This book should be read by all interested in practical transmission-line practice.

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The National Parks And Forests Of The United States.

OUR NATIONAL PARKS.—By John Muir. New and enlarged edition. Boston and New York: Houghton Mifflin Co. Cloth; 5⅜ × 8⅛ ins.; pp. 382; 33 plates. $1.75, net.

Nearly ten years ago Mr. John Muir brought together in a very interesting volume a number of papers on our national parks and related subjects, which had appeared from time to time in the "Atlantic Monthly." The volume has recently been enlarged by a number of handsome illustrations (from photographs taken for the purpose), by some statistical and descriptive tables showing our national parks, monuments and forests up to the middle of 1909, and by the inclusion of a map showing the location of these national possessions. (The forests alone now total about 200 million acres.) There do not seem to have been any changes in the text, further than the addition of a few foot-notes to correct statements which have become obsolete or inaccurate through the acquisition of additional parks and forest reserves, or through provision of better means for safeguarding them.

Seven of the ten chapters composing the book deal with the Yosemite National Park, with its forests, wild gardens, animals, birds, fountains and streams. Another chapter contains the results of a very interesting survey of the Sequoias, or Big Trees, in what are now the Sequoia and General Grant national parks. By "survey" we do not mean to indicate any accurate measurements or delineations of areas and altitudes, but merely a general statement of such limits based on personal explorations made before very much was known about our sequoias beyond information pertaining to the first of the "big tree" growths to come to public attention.

The opening chapter deals with national parks in general, as established some years back. The closing chapter deals with the broad subject of "American Forests." This chapter also deals with conditions as they existed some years ago, although unfortunately much of the neglect of our forest possessions and much of the wanton waste which Mr. Muir describes in this chapter still continue. A careful revision of portions of this chapter would have added to its strength and possible influence.

The usefulness of the volume is greatly increased by a carefully prepared and somewhat detailed index.

For the benefit of those who are unfamiliar with the attractive style of Mr. Muir and the spirit which pervades his writings, we quote the opening paragraph of the first chapter as follows:

The tendency nowadays to wander in wildernesses is delightful to see. Thousands of tired, nerve-shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wildness is a necessity; and that mountain parks and reservations are useful not only as fountains of timber and irrigating rivers, but as fountains of life. Awakening from the stupefying effects of the vice of over-industry and the deadly apathy of luxury, they are trying as best they can to mix and enrich their own little ongoings with those of Nature, and to get rid of rust and disease. Briskly venturing and roaming, some are washing off sins and cobweb cares of the devil's spinning in all-day storms on mountains; sauntering in rosiny pinewoods or in gentian meadows, brushing through chaparral, bending down and parting sweet, flowery sprays; tracing rivers to their sources, getting in touch with the nerves of Mother Earth; jumping from rock to rock, feeling the life of them, learning the songs of them, panting in whole-souled exercise, and rejoicing in deep, long-drawn breaths of pure wildness. This is fine and natural and full of promise. So also is the growing interest in the care and preservation of forests and wild places in general, and in the half wild parks and gardens of towns. Even the scenery habit in its most artificial forms, mixed with spectacles, silliness, and kodaks; its devotees arrayed more gorgeously than scarlet tanagers, frightening the wild game with red umbrellas—even this is encouraging, and may well be regarded as a hopeful sign of the times.

The people of Los Angeles can scarcely fail to be pleased with the following statement regarding one of the headwaters of the new water-supply to be introduced by the aqueduct now under construction:

The water of one of the branches of the north fork of Owens River, near the southeastern boundary of the park, at an elevation of 9,500 ft. above the sea, is the best I ever found. It is not only delightfully cool and bright, but brisk, sparkling, exhilarating, and so positively delicious to the taste that a party of friends I led to it 25 years ago still praise it, and refer to it as "that wonderful champagne water"; though, comparatively, the finest wine is a coarse and vulgar drink. The party camped about a week in a pine grove on the edge of a little round sedgy meadow through which the stream ran bank full, and drank its icy water on frosty mornings, before breakfast, and at night about as eagerly as in the heat of the day; lying down and taking massy draughts direct from the brimming flood, lest the touch of a cup might disturb its celestial flavor.

Mr. Muir's position on the much-discussed question of the relation of forests to the conservation of water-supplies may be illustrated by the following quotation:

"Why, then," it will be asked, "are the Big Tree groves always found on well-watered spots?" Simply because Big Trees give rise to streams. It is a mistake to suppose that the water is the cause of the groves being there. On the contrary, the groves are the cause of the water being there. The roots of this immense tree fill the ground, forming a sponge which hoards the bounty of the clouds and sends it forth in clear perennial streams instead of allowing it to rush headlong in short-lived destructive floods. Evaporation is also checked, and the air kept still in the shady Sequoia depths, while thirsty robber winds are shut out.

The book can scarcely fail to appeal to any one who is interested in streams, forests and mountains. It abounds in pen pictures drawn in broadest outlines, and also in those which show minor details of natural scenery, such as the tiny plants and flowers of the woods and natural gardens which Mr. Muir so lovingly describes.

Two Books for Automobile Owners.

AUTOMOBILE DRIVING SELF-TAUGHT.—An Exhaustive Treatise on the Operation, Management, and Care of Motor Cars. By Thomas H. Russell, Editor of "The American Cyclopedia of the Automobile," Author of "History of the Automobile," etc. Chicago, Ill.: The Charles C. Thompson Co. Cloth or flexible leather; 5¼ × 7¾ ins.; pp. 222; plates and text illustrations. Cloth, $1; flexible leather, $1.50.

IGNITION, TIMING AND VALVE SETTING.—A Comprehensive Illustrated Manual of Self-Instruction for Automobile Owners, Operators, Repairmen, and All Interested in Motoring. By Thomas H. Russell, Editor of "The American Cyclopedia of the Automobile," Author of "History of the Automobile," etc. Chicago, Ill.: The Charles C. Thompson Co. Flexible leather or cloth; 5¼ × 7¾ ins.; pp. 223; plates and numerous text illustrations. Leather, $1.50; cloth, $1.

As would be inferred from its title, the first of these books will be of interest mainly to prospective owners of their first machine rather than to the seasoned veteran who already conceives himself a past-master of the art of automobile driving. Although doubtless written for drivers of pleasure vehicles, it might be read with advantage by some automobile truckmen. The latter part of the book, which explains in simple terms the main features of typical operating mechanisms, will be of value to many who are expert at pulling the levers but are not quite sure what does the rest.

The first two chapters give general instructions in starting, changing speeds, etc., explaining the general principles governing the sequence and relation of the various manipulations, and then take up the subject of behavior and management under different circumstances, such as ascending and descending grades and driving in crowded traffic. The next two chapters cover about the same general topics but are written in greater de-

tail, as though intended for some one lacking even the most elementary knowledge of automobile mechanisms and their operation. The remaining chapters, comprising more than half the book, explain some of the possible causes of trouble in starting and keeping in motion a gasoline automobile engine, give directions for proper care and maintenance and finally describe typical control mechanisms and transmissions.

The author shows considerable patience in setting forth in great detail all phases of his subject and the book should be readily comprehended by anyone.

Almost all of the second book is devoted to ignition systems. Valves and valve setting are given only a few pages. The battery and coil and the magneto systems of ignition are treated upon, and the information on all of these has been brought well up to date. The details of construction and principles of operation of spark coils, low and high-tension magnetos, contact makers, spark plugs and other parts of automobile ignition systems are described at sufficient length to make them pretty well understood, and the methods and precautions for timing a disarranged ignition system are carefully explained.

Producer-Gas Industrial Furnaces.

Reviewed by CHARLES E. LUCKE,* M. Am. Soc. M. E.

PRODUCER GAS FIRED FURNACES.—A Handbook for Engineers, Chemists, Manufacturers, Superintendents and Students. By Oskar Nagel, Ph. D., Consulting Chemical Engineer, Author of "The Mechanical Appliances." New York: The Author (P. O. Box 385). Cloth; 6 x 9¼ ins.; pp. 192; 237 illustrations in the text. $2, net; English price, 8s. 6d., net.

This book consists mainly of illustrations and descriptions of industrial furnaces in which it has been found convenient to burn gas generated directly from coal fuel by gas producers. There are also brief treatments of the construction of gas producers and the processes of gasification of coal and purification of gases.

The first chapter, on The Generation of Producer Gas, consists of a six-page discussion of the reactions to be expected in the gasification of coal, and is somewhat superficially written.

The Construction of Gas Producers is a thirty-one page presentation of producer descriptions, illustrated by cross-sections, with no data, whatever, on performance and no critical analysis of the defects or merits based on data of performance. There are many much better discussions of producer theory, construction and performance to be found elsewhere.

The Combustion of Producer Gas is treated in only six pages, which are mainly concerned with gas burners or means of bringing air and gas together in furnaces.

Special furnace designs for use in the chemical industries are described without any test data in 11 pages, including a furnace for smelting soda, zinc, bone-black, and, strangely enough, a gas producer connected to and firing a steam boiler. This last combination should attract the attention of steam-power engineers, who will immediately ask the question, "How does the increased cost of adding a gas producer to a steam boiler produce gains that will warrant the extra investment?" On which question the author presents no data whatever, except to say "Coal is charged into the producer every half hour; as unskilled laborers can be used for this work, a considerable saving is effected, as compared to direct firing with skilled firemen." It is believed that no central station man can be induced to accept this statement and install gas producers to fire his boilers with the expectation of affecting any saving.

Further descriptions of industrial furnaces applied to the metal industries, such as to the melting of small castings, the heating of copper plates, together with various types of crucible, puddling and muffle furnaces for steel making and for hot rolling mill pits, are given. The same treatment is extended to lime kilns and cement kilns, glass furnaces, brick and ceramic kilns and furnaces. A somewhat better treatment is accorded to the Selection of Refractory Materials, but the treatment of purification and recovery of gases in the Appendix and references to gas power, are entirely inadequate and in many respects quite misleading.

The subject of the book is so promising and recent developments in gasification of coal so productive that the author might fairly have been expected to produce a more convincing and authoritative presentation of even the generally known facts, while familiarity with the details of the various processes should have made it possible to present much new material, especially of a quantitative sort, which is almost entirely lacking in the book. The relation of the gas producer to the gas furnace portions of the book remind one of the mathematician-philosopher, who was a mathematician among philosophers and a philosopher among mathematicians.

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Speculations on Molecular Mechanics.

ENERGY.—Work, Heat and Transformations. By Sidney A. Reeve. New York: McGraw-Hill Book Co. Cloth; 6 x 9 ins.; pp. 238; 14 illustrations in the text. $2, net.

Mr. Reeve begins an iconoclastic monograph with several disconcerting statements:

It is neither space nor motion alone which constitutes energy, but *change* in space or motion (p. 9).

We have been accustomed to consider that change in motion of a mass signifies work-performance, or change in energy, not energy itself.

A suspended weight possesses no energy if it can never fall. A flying cannon-ball can overcome no resistance if nothing ever interferes with it to stop it (p. 9).

No doubt a zero-point of elevation is necessary, from which to measure energy; for a stone on the sea-bottom is far from the earth's center, yet will doubtless never be able to fall to it; but why then speak of a *suspended* weight, implying one that has been lifted up, or one in which energy has been stored? A cannon-ball moving in relation to the earth may be stationary in relation to the moon; we do not know whether it is stationary or moving in respect to the center of gravity of the entire universe; thus, we necessarily must refer its velocity to some fixed base, before we can estimate its velocity or energy, or even say it possesses velocity or energy. But why then speak of it as a *flying* cannon-ball, which already concedes the motion?

Let him try to forge a bolt upon an anvil made of wet clay. . . . Motion may be there, but not necessarily kinetic energy (p. 15).

Such unconventional assertions do not induce a receptive condition for the author's further exposition of Energy. Perhaps this is why our attempt to read the book was not easy, and not very satisfactory. Still a statement of the contents can be given. Let it be said beforehand that the text throughout is tarnished by patches of confusing statement even less acceptable than the above.

The book is in the main an attempt to explain mechanical action, heat and other physical phenomena by means of orbital motion of swarms of particles within the molecule or atom. This may not be altogether new, but the author is doubtless original in identifying various physical manifestations or quantities with certain specific attributes of the orbitally-moving system, such as the mean eccentricity of orbit, velocity at mean separation, proportion of hyperbolic orbits in the swarms, etc.

Intimately mixed with this explanation is a steady insistence on the contrast between intensity and extensity of any energy form, with the chief purpose, apparently, of setting forth clearly what entropy is. This purpose failed deplorably in the reviewer's case.

There are many engaging ideas and suggestions throughout the orbital-system part of the book. Wherever the text is specific it is instructive, sometimes highly so, if we except some points that seem weak, erroneous or meaningless. But the author also indulges in much general talk, and toward the close he goes off into some sociological or economic side-remarks; this matter is too much involved in heavy flow of words to convey much meaning.

The main part of the book is preceded by some algebraic matter on orbital motion of mass-pairs. This is far too condensed to be satisfactory, and as it is not essential to an understanding of the rest of the book it may be omitted by the reader. However, this algebraic analysis is used as the backing for a sharp attack on the way the subject of mechanics is currently taught, and this seems to us important, in that it is fundamentally wrong.

The author says it is absurd to talk of an isolated mass-particle, and that rectilinear motion has no existence in the universe; that instead the foundation should be a pair of particles engaged in orbital motion about each other. Now it appears that he is inconsistent in this. His formulas for kinetic energy and for centrifugal force of the particle engaged in orbital motion are derived from the equations for forces and motions of a single particle engaged in rectilinear motion! Besides, how could he know of centrifugal force, let alone get a formula for it, if he did not begin with rectilinear motion?

These inconsistencies tend to shake the reader's faith in the author's infallibility, and make it hard for him to accept the many dogmatic assertions employed in the subsequent presentation of hypothesis. There is also an inconsistency of another character that has the same tendency. The author speaks of velocities as being only relative, and, by implication, of revolution as being such only in relation to an arbitrarily chosen set of fixed directions. Yet he deals with centrifugal force, which seems to require absolute rotation and absolute direction. Thus the reader is left fairly well tangled up before he ever begins on the molecular hypothesis which the text aims to present. On this basis the author is ill advised to attack our fundamentals of mechanics, the engineer's most important science.

We can recommend the book as interesting to all who possess the patience to study a not-too-well-argued speculative reasoning on ultimate physical theory. Such readers will also be interested in the author's unconventional choice of words, culminating in the invention of two new terms, "thermogy" and "labority," which apparently mean heat-transfer and heat-transformation. "Propinquity" as the quantitative reciprocal of "separation" is also new in physical science, so far as our limited acquaintance with the study extends. Finally, a spectacular point of the argument of the book, an explanation of contact-pressure by analogy to a quadrille, may prove of interest to some readers.

GAS, GASOLINE, AND OIL-ENGINES, INCLUDING PRODUCER-GAS PLANTS.—A Complete and Practical Work Treating on Gas, Gasoline, Kerosene and Crude Petroleum Oil-Engines, Including Producer-Gas Plants for Gas-Engine Owners, Gas Engineers, and Intending Purchasers of Gas-Engines, Fully Describing and Illustrating the Theory, Design, Construction, and Management of the Explosive Motor for Stationary, Marine, and Vehicle Motor Power. By Gardner D. Hiscox, Author of "Mechanical Movements," etc. 18th edition, revised and enlarged. New York: The Norman W. Henley Publishing Co. Cloth; 6 x 9¼ ins.; pp. 476; 412 illustrations in the text. $2.50, net.

The 18th edition of Gardner D. Hiscox's very popular book on internal-combustion engines is at hand. This book continues in its run of popularity although, in various reviews of previous editions, great and glaring faults have been noted. The late Professor Storm Bull, in reviewing the 15th edition (Eng. News, Feb. 15, 1906), called attention to the small value of the theoretical parts and the attractiveness in many respects of the practical parts. These statements still hold true largely, and it seems as though the book has not improved as one would expect with the increase in number of editions. The good illustrations and excellent make-up are continued, and the book shows its attractiveness for a reader without a thorough technical training.

The preface to the 18th edition, stating the improvements that have been made, is signed by the author and dated January, 1910, although the author died several months previous to that date.

Linseed Oil and Its Manufacture.

Reviewed by A. H. SABIN,* Assoc. M. Am. Soc. C. E.

LINSEED OIL AND OTHER SEED OILS.—An Industrial Manual. By William D. Ennis, M. Am. Soc. M. E., Professor of Mechanical Engineering in the Polytechnic Institute of Brooklyn. New York: D. Van Nostrand Co. Cloth; 6 × 9½ ins.; pp. 316; 71 illustrations, mostly in the text. $4, net.

There are not many things connected with the manufacture of linseed oil which are not treated in this book. The method of handling the seed, and separation of impurities, comes first, then the grinding, with description and illustrations of mills, their speed, adjustment and capacity; heating (tempering) the meal, preparation of cake, construction and operation of presses; hydraulic outfit; clarifying, filtering, storing, packing and shipping the oil; treatment and marketing the oil-cake; then come chapters on the yield and output of oil, the various conditions which influence it, and the exact advantages and disadvantages of these conditions; a practical and mathematical discussion of shrinkage, and of cost of production; then follow sections on the merits of various types of mills, and extraction by percolation and by the Anderson expeller. This expeller is a most interesting and ingenious machine, continuous in its action, which by a screw propeller squeezes the oil out and then ejects the exhausted seed.

The cultivation of flax is described, with statistics of the crops in all parts of the world; and the manner of sale, contract and delivery, and methods of shipment.

Chapters amounting to 10% of the book are given to descriptions of linseed oil in its various grades, and its chemical characteristics and treatment. There is a chapter on cotton oil, and one on miscellaneous seed oils of minor importance.

The book is clearly written, and is noticeable for the free use of simple mathematical formulas to exactly express the working of operations and conditions. Precise figures are almost everywhere given, and the treatise is the most complete and exhaustive on the subject which has yet appeared. The illustrations are good, but not very well arranged. The table of contents and index are good, and there is a glossary; the printing and binding are excellent.

SELECTED ARTICLES ON THE COMMISSION PLAN OF MUNICIPAL GOVERNMENT.—Compiled by E. Clyde Robbins. Minneapolis, Minn.: The H. W. Wilson Co. Cloth; 5¼ × 7¾ ins.; pp. 168. $1, net.

The present widespread interest in municipal government, and especially in the so-called commission plan, makes particularly timely any conveniently arranged compilation of valuable articles and discussions on the subject. The little volume before us brings together some papers, magazine articles and daily press editorials on, first, the general subject of municipal government, next the commission plan in general, and then on the affirmative and negative sides of the plan. It is stated in the preface that an attempt has been made to avoid repetition. This attempt might well have been carried further. In addition, some of the articles reprinted contain loose general statements and compilations of figures which are of little or no value for the purposes of the book—or, for that matter, for any other purpose.

A brief summary at the conclusion of the book indicates that up to Aug. 1, 1909, so far as could be learned, 18 states had passed legislation providing for the corporation plan, and 36 cities had actually adopted that form of government.

A fairly extensive bibliography is given, with stars to indicate whether or not the whole or a part of the articles referred to have been printed in the book, and also with directions for obtaining the articles listed. The volume has no index.

The usefulness of the book would have been increased had there been appended something in the way of editorial summary and criticism of the articles printed on both sides of the question. Perhaps, however, this is too much to expect.

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Certainly, good service has been rendered, not only to would-be debaters (for whom the book is primarily intended), but also to any one who wishes to look up this subject, by bringing together so many articles which could have been made available only with difficulty and expense by the individual student. Another but minor improvement would have been a few words regarding each of the authors quoted, in order to show by what right and authority they were discussing the commission plan. The book as a whole, as we have already indicated, deserves commendation. It is particularly valuable to those who wish to know what has been written against the commission plan, although it must be said that most of the articles on the negative side seem to be relatively weak.

An Interpretation of the British Employer's Liability Act of 1906.

THE WORKMEN'S COMPENSATION ACT, 1906.—By V. R. Aronson, M. A., B. C. L., of the Inner Temple and Midland Circuit, Barrister-at-Law. London and Leipsic: T. Fisher Unwin. Cloth; 5½ x 9 ins.; pp. 558. 15s., net; American price, $6, net.

Under parliamentary acts passed in 1897 and 1900, certain classes of employees in Great Britain have been legally authorized to collect compensation for injuries suffered while at work, and in case of death the dependants of the employees have been entitled to damages. The earlier acts were limited to a few special industries, and were in a measure designed to secure practical information to serve as a basis for more general legislation. In 1906 a much broader act was passed, which virtually extends the compensation for injuries to every class of employees. This later act went into effect in July, 1907.

The book before us is designed to set forth the intent of the 1906 act in all its details, and to show its workings in the light of many decisions in the English and Scotch courts, both before and since the act. Some of the earlier decisions cited are based on the legislation of 1897 and 1900, and some on the common law regarding what we know in this country as employers' liability.

The volume opens with a brief review of the law prior to 1906, followed by a summary of the act of that year in which its provisions are set forth in their logical relation one to the other, instead of in their actual sequence. The main part of the book is taken up with comments on the act of 1906. The plan followed is to first give an article of the act and then to explain its meaning in the light of the context and of court decisions. Nearly half of the volume is occupied by appendixes containing rules formulated by the Government to carry the act into effect and to define its provisions in more specific terms for administrative purposes. Various court forms acquired in submitting claims for damages are included.

Broadly speaking, the act of 1906 entitles any workman injured while in the line of his employment to a weekly allowance during the period that he is incapacitated for work, either by accident or by disease incident to his employment. In case of death, the different possible classes of persons dependent upon the employee are entitled to death claims, varying with the degree of relationship. The maximum claims are for three years' wages, or a total of £150 in case the wages fall under that amount; but no allowance in excess of £250 is to be made. The diseases specified in the original act were anthrax, lead poisoning or its sequelae from lead, mercury, phosphorus or arsenic, and ankylostomiasis.

The act provided that this list might be extended from time to time by the Home Secretary of the National Government. An extension was made in May, 1907, which includes 18 other diseases or injuries, due chiefly to poisoning from various causes but including "eczematous ulceration of the skin produced by dust or caustic or corrosive liquids, or ulceration of the mucous membrane of the nose or mouth produced by dust." The list also includes compressed-air illness or its sequelae, and various muscular affections incident to mining.

As many of our readers know, there is a strong movement being made in the United States to secure an extension of employers' liability far beyond its present limits, which as a rule cover nothing but accidents which can be clearly proven as due to defective machinery or the negligence of employers. The British act makes all accidents and all diseases due to employment a charge upon the industry concerned. That is to say, the industry has to stand wreck of the human being just as fully as it does that of the machine which is destroyed by some accident. The book before us should prove of great value to all who are interested in proposed American legislation of the same kind.

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FOWLER'S MECHANICAL ENGINEER'S POCKET BOOK, 1910.—Edited by William H. Fowler, M. Inst. C. E., M. Inst. M. E., etc. 12th annual edition. Manchester, England: Scientific Publishing Co. Cloth or leather; 3¾ x 6¼ ins.; pp. 71 + 635; text illustrations. Cloth, 1s. 6d., net; post free, 1s. 9d. Leather, 2s. 6d., net; post free, 2s. 9d.

FOWLER'S ELECTRICAL ENGINEER'S POCKET BOOK, 1910.—Edited by William H. Fowler, M. Inst. C. E., M. Inst. M. E., etc. 10th annual edition. Manchester, England: Scientific Publishing Co. Cloth; 3¾ x 6¼ ins.; pp. 47 + 575; text illustrations. 1s. 6d., net; post free, 1s. 9d. Superior binding, 2s. 6d., net; post free, 2d. 9d.

A new annual edition of these popular English handbooks has made its expected appearance. The price on both of them is so insignificant that the older editions may be given away or thrown away by one who has much use for them, that he may receive the benifits of the latest editions. Both of these books in many ways are admirable, and compilers of American handbooks would do well to study Mr. Fowler's methods of arrangements in many cases.

The mechanical-engineering handbooks is the same as the previous annual edition in about half of the book. This discussion on temperature-entropy diagrams is cut down to a single table of entropy values for water and steam. The sections on matallurgy of iron and steel have been revised as has the section on mining machinery.

The electrical engineering handbook is somewhat thinner than some of the previous editions, indeed being abbreviated 112 pages over the 1908 edition. Some minor subjects have disappeared as distinct topics and there is a consistant condensation of the whole subject matter generally.

BLOCK SIGNAL AND TRAIN CONTROL BOARD.—Second Annual Report to the Interstate Commerce Commission. Nov. 22, 1909. (M. E. Cooley, Chairmain of Board.) Washington, D. C.: Pub. Doc. Paper: 5¾ x 9 ins.; pp. 93; 30 illustrations, partly in the text.

The Board whose report is contained in this pamphlet was appointed on July 10, 1907, to investigate and report to the Interstate Commerce Commission upon appliances and systems for promoting safety in railway operation, particularly with respect to the use of block signals and safety stops. The Board has done a very large amount of work in connection with the investigation of automatic stops, cab signals, and other modifications of the block system and other systems of moving trains. It has also taken up the matter of ashpans, air-brakes, and inventions relating to track and rolling-stock. An appendix contains a detailed report of the Rowell-Potter safety stop, a report on the "A B C system" of signaling in use on the Northern Pacific Ry., a report on the use of titanium as a constituent of rails, a report on locomotive ashpans by Mr. George L. Fowler, and a report, also by Mr. Fowler, on car wheels which revolve independently upon the axle. This last report is of especial interest, in view of the recent revival of this old scheme. Mr. Fowler's report gives the history of the Miltimore axle, which was exploited in the years from 1876 to 1880. Mr. Fowler's advice in his report is that the Board is not warranted in spending any time investigating inventions of loose wheels. He shows that even if a mechanically perfect loose wheel were produced, the commercial advantage over the present rigid wheel and axle would be very slight.

ILLUSTRATED TECHNICAL DICTIONARY.—In Six Languages: English, German, French, Russian, Italian, Spanish. Edited according to the novel method (Deinhardt-Schlomann) by Alfred Schlomann, Engineer. New York: McGraw-Hill Book Co. London: Archibald Constable & Co., Ltd. Munich-Berlin: R. Oldenbourg. Paris: H. Dunod & E. Pinat. St. Petersburg: K. L. Ricker. Milan: Ulrico Hoepli. Madrid: Bailly-Bailliére é Hijos. Cloth; 4 x 7¼ ins.
Vol. V.: Railway Construction and Operation. Compiled by August Boshart. Pp. 870; about 1,900 text illustrations and numerous formulas. $4, net.
Vol. VI.: Railway Rolling Stock. Compiled by August Boshart. Pp. 796; about 2,100 illustrations and numerous formulas. $3, net.

Two more volumes of a series of technical dictionaries in six languages are now at hand. In general only such expressions have been included as refer, originally or principally to railways. However, in some branches of railway engineering, such as surveying, earthwork, bridge construction, etc., many related expressions have been included as they were judged essential by the editor. A full dictionary of such branches has not been given, however, in this volume.

Vol. V. is arranged under these topics: (1) general railway expressions, (2) preparation for construction, (3) track, (4) permanent way, (5) switches, crossings, etc., (6) stations, (7) electric railways, (8) signals and safety devices, (9) tools, (10) service terms. The index occupies 333 pages—over a third of the volume.

Vol. VI. covers rolling stock, arranging the terms in eight topical groups; (1) running, buffing and braking gears, (2) locomotives and motor cars, (3) coaches, (4) special rolling stock and attachments—such as inclined and monorail-road equipment, (5) train lighting, (6) electric railways, (7) train ferrys, (8) railway shops.

In these two volumes, as in the previous ones, the scheme has been used of showing the picture of a device or of a type of construction in the middle of the page and placing on both sides the six expressions for the name. The cuts though almost minute are clean and clear. Throughout a high degree of usefulness seems to have been secured, as in previous volumes.

Water-Power Development and Regulation.

THE PUBLIC UTILITY OF WATER POWERS AND THEIR GOVERNMENTAL REGULATION.—By René Tavernier, Chief Engineer, Department of Public Works, Republic of France, and Marshall O. Leighton, Chief Hydrographer, United States Geological Survey. Water-Supply Paper 238, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ x 9 ins.; pp. 161.

In the active discussion now going on with reference to the relation of the Federal and State governments to water-power development, this monograph is especially timely. Chief space in the pamphlet is devoted to a series of papers by M. René Tavernier, Chief Engineer of the Department of Public Works of France. M. Tavernier discusses French, Italian and Swiss legislation with reference to water-power development, and traces the growth toward public control and public ownership of water-power plants. The final chapter of his paper describes the work of the Bureau of Hydraulics and Agricultural Improvements in the French Department of Agriculture.

The introduction to the pamphlet is prepared by Mr. Marshall O. Leighton, Assoc. M. Am. Soc. C. E., Chief Hydrographer, United States Geological Survey. We quote the opening sentences as follows:

> This paper is published to show how the French and the Swiss Republics and the Kingdom of Italy are treating a grave problem in their political economy—the problem of water-power. The people of the United States are facing the same problem, although, except in a few notable localities, they have not begun to apply any method of serious treatment. The problem has grown well-nigh to maturity within ten years, and few have been aware. Had the country foreseen what has come to pass, its treatment would have been easy. In its early years the issue might have been easily guided; now it will dominate a great controversy.

Mr. Leighton's discussion is commendably temperate. He points out that, while corporate abuses need a remedy, the development of water-powers by private enterprise has not been a business of great financial returns; "notwithstanding the testimony of many popular magazine articles, it [the hydro-electric industry] bears no resemblance to Aladdin's lamp as a revenue producer." Regarding consolidation of water-power companies, concerning which so much has appeared in public prints, Mr. Leighton wisely remarks that consolidation is inevitable, that water-power is a natural monopoly, and that there is no virtue in preventing consolidation if economies in maintenance and operation are thereby prevented.

The concluding chapter in the pamphlet, also by Mr. Leighton, reviews the water-power legislation in the United States. Space is chiefly devoted to the federal statutes and the current discussion as to the authority of the United States to assess any toll or license fee for the use of water-power on navigable streams. The state legislation of Pennsylvania, New York and Oregon is also fully reviewed. In conclusion, Mr. Leighton points out that in the Old World the governments have declared water-powers to be public utilities, and therefore subject to public regulation. In this country, Mr. Leighton says, no one can safely predict whether government ownership and control will be established, and how the responsibility shall be divided between the state and the national governments.

THE COMPUTATION OF AREA.—A Simple Treatise. By Frank J. Gray, Assoc. M. Inst. C. E., F. R. G. S. London, England: St. Bride's Press, Ltd. Paper; 4¾ x 7¼ ins.; pp. 64; 27 illustrations in the text, and one folding table. 1s., net; American price, 50 cts.

We have heard of the German professor who spent his mature lifetime in the investigation of the dative endings of the second declension as found in the works of Plautus and we are almost ready to believe that the author of the little book before us approaches him in the infinite capacity for detail. Here are 64 closely printed pages devoted to "only a portion of an elementary subject—namely, the computation of the areas of plane surfaces." The discussion starts with the simplest geometrical figures and follows through the various approximate and transcendental formulas for areas. By way of help are included chapters on logarithms and slide rules. It is complete; that in fact is its fault, it is so very complete.

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Primarily, it should be stated that this is a British book and in so far as it discusses statutory requirements and limitations, its application to American practice is restricted. Those portions which treat of the powers and duties of the engineer, his rights and duties under the common law, and his conduct as an expert witness, are equally applicable in England and America.

The book takes up in succession the status of the engineer, which includes a discussion of engineering ethics, the question of fee or salary, the engineer as a witness, and the possible charge of negligence against an engineer. The next 14 chapters relate to contracts and specifications, in the light of court decisions and experience. The final nine chapters are upon "Arbitrations and Awards" and discuss the duties of an engineer in the peculiarly British institution of an arbitrator appointed by the court. This custom, warranted by law in England, enables a judge to appoint arbitrators who shall have the power to decide cases brought before them. In this country the "referee" in bankruptcy or a divorce suit is an analagous officer, but the engineer is not so often called to such duties. As an appendix a number of model contracts and specications are given.

CANAL ENLARGEMENT IN NEW YORK STATE.—Papers on the Barge Canal Campaign and Related Topics. Buffalo, N. Y.: Buffalo Historical Society (Frank H. Severance, Secy.) Paper or cloth; 6¼ x 9¾ ins.; pp. xvii. + 446; 15 plates. Paper, $4; cloth, $5.

The Buffalo Historical Society is engaged in recording in its publications a complete history of the birth and development of the canal system of New York State. We have already reviewed one of these volumes, "Waterways and Canals in New York State," by Henry W. Hill (June 11, 1909, p. 82). The work noted in the headpiece above covers a different phase of the subject, namely, the non-official papers on the canals, the addresses and reports by private citizens and associations, who, through the past century, have fought the anti-canal sentiment of the state.

The book is divided into two parts; the first on the barge-canal movement from 1895 to 1903; the second, a collection of papers on some of the early engineers and their work on the original Erie Canal. There is also included an historical sketch of the Board of Trade of the city of Buffalo.

The members of the Buffalo Historical Society are valiant defenders of the canals of the state and rarely in their publications do they allow anything but pro-canal sentiment to appear. One can hardly expect, then, to find but one side of the waterways question in the economic and engineering discussions of the first part of the book. In the purely historical descriptions in the latter part of the book there is, of course, no chance for a display of bias, and the interest is much more general. The tributes to the early engineers and the accounts of their work which are being collected by the Society are especially valuable and interesting to the engineering profession.

HOW TO USE CONCRETE.—Compiled by Walter C. Boynton, Editor of "Concrete," and R. Marshall, Associate Editor. A Book of Practical Information not found elsewhere about the uses of concrete. Detroit, Mich.: Concrete Publishing Co. Cloth; 6 x 9¼ ins.; pp. 233; text illustrations. $1.

This book is a collection of papers regarding the more popular uses of concrete as a decorative and minor structural material, compiled, apparently, by the authors in the course of their professional duties. It contains separate chapters on the proper methods to employ in the making of such things as balustrades, boats, flower pots,

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benches, bath-tubs, sidewalk-block, etc., all out of concrete, and devotes some attention to the construction and costs of pavements, sidewalks, gutters and bridges of simple design. It is concluded with some 60 pages of "miscellaneous information" taken evidently hap-hazard from the "Information Department" of some journal.

DIE BESTIMMUNG DER QUERSCHNITTE VON STAUMAUERN UND WEHREN AUS DREIECKIGEN GRUNDFORMEN.—By E. Link. Berlin, Germany: Julius Springer. Paper; 6¼ x 9½ ins.; pp. 61; 33 illustrations in the text. 2.40 marks; American price, $1.

There is no lack of published matter on dams; yet this new contribution does not fail of meriting a place. The point of attack which the author selects is the determination of general outline, as he seems to be dissatisfied with the common method of fixing thickness by successive increments of height. The triangular section being the ideal one theoretically (for zero crown width), he attempts to find how this section must be modified for crown surcharge, and he succeeds in deducing quite simple modifications. Inasmuch as the point-to-point method does not yield a profile of theoretical perfection, he regards it as proper to fix the profile (at least a tentative one) on the basis of such general considerations, leaving it to a subsequent analysis of the stresses in the various directions at different levels to decide on the sufficiency of the assumed dimensions. The author's connection with two large dams now being built assures his deductions at least a fair measure of practical character.

THE CALCULUS AND ITS APPLICATIONS.—A Practical Treatise for Beginners, Especially Engineering Students. By Robert Gordon Blaine, Assoc. M. Inst. C. E., Lecturer at the City Guilds Technical College, Finsbury, London, E. C., Author of "Hydraulic Machinery," etc. New York: D. Van Nostrand Co. Cloth; 4¾ x 7¼ ins.; pp. 321; 79 illustrations in the text. $1.50, net.

The author's style and arrangement of matter is more attractive, or less dry, than that of many current tests on the calculus. He also improves on the usual run of "practical" problems, to the student's profit. The book can therefore prove useful, either in teaching or in self-study, and merits successful survival.

Publications Received.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION.—Proceedings, 1909. Containing a Complete Report of the 7th Annual Convention, Held at Denver, Colo., Oct. 5-8, 1909. New York: The Association (29 West 39th St.; John W. Corning, Secy.). Cloth; 6 x 9½ ins.; pp. 386; folding and other plates, and text illustrations.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—Proceedings, Chattanooga, Tenn., December, 1909. (G. P. Conard, Secy., 24 Park Place, New York.) Paper; 5½ x 8½ ins.; pp. 1579 to 1750.

COLLECTION AND DISPOSITION OF GARBAGE AND OFFAL IN THE CITY OF BOSTON.—(Reports of First and Second Special Commissions Appointed to Investigate the Subject; Francis Reginald Bangs, Chairman.) Submitted to Hon. George A. Hibbard, Mayor of Boston, Nov. 8, 1908, and Jan. 31, 1910. Boston, Mass.: Pub. Doc. Paper; 5¾ x 9 ins.; pp. 25 and 32.

DEPARTMENT OF RAILWAYS AND CANALS (Canada). —Report for the Fiscal Year from April 1, 1908, to March 31, 1909. (M. J. Butler, Deputy Minister and Chief Engineer.) Ottawa, Can.: Pub. Doc. (No. 20—1910). Paper; 6½ x 10 ins.; pp. 410; 11 maps in separate envelope. 30 cts.

DIRECTORY OF PORTLAND CEMENT MANUFACTURERS.—Together with Manufacturers of Gypsum and Lime. Corrected to Jan. 1, 1910. Chicago, Ill.: The Cement Era. Flexible leather; 3 x 5 ins.; pp. 256. $1.

ELECTRIC POWER PLANT ENGINEERING.—By J. Weingreen. New York: McGraw-Hill Book Co. Cloth; 6 x 9¼ ins.; pp. 431; 291 illustrations, partly in the text. $5, net.

ELEMENTARY COURSE IN PERSPECTIVE.—By Sherman M. Turrill, Assoc. Am. Soc. C. E. New York: D. Van Nostrand Co. Cloth; 5 x 7¼ ins.; pp. 71; 16 illustrations, partly in the text. $1.25, net.

THE ESSENTIALS OF LETTERING.—A Manual for Students and Designers. By Thomas E. French and Robert Meiklejohn. Second edition. Columbus, O.: Varsity Supply Co. Cloth; 9 x 6¾ ins.; pp. 72; 74 illustrations in the text. $1.

THE FLOW OF WATER.—A New Theory of the Motion of Water under Pressure and in Open Conduits and Its Practical Application. By Louis Schmeer, Civil and Irrigation Engineer. New York: D. Van Nostrand Co. Cloth; 6 x 9¼ ins.; pp. 228; text illustrations and tables. $3, net.

ILLUMINATION AND PHOTOMETRY.—By William Elgin Wickenden, Assoc. M. Am. Inst. E. E., Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology. New York: McGraw-Hill Book Co. Cloth; 6 x 9¼ ins.; pp. 195; 116 illustrations in the text. $2, net.

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INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.—Proceedings of the Annual Convention Held at Grand Rapids, Mich., Aug. 17-20, 1909. (Published by the Secretary, James McFall, Roanoke, Va.) Paper; 6 × 8¾ ins.; pp. 191; text illustrations.

IRRIGATION INVESTMENTS.—By Ira W. McConnell, Chief Irrigation Engineer, J. G. White & Co., Inc. New York: J. G. White & Co. Paper; 5½ × 8¼ ins.; pp. 16.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE.—Vol. LXXX. No. II., 1909. Edited by George C. Lloyd, Secretary. London, England: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 5½ × 8¾ ins.; pp. 587; text illustrations, and 20 plates. $6.

THE MECHANICS' HANDBOOK.—A Convenient Reference Book for All Persons Interested in Mechanical Engineering, Steam Engineering, Electrical Engineering, Railroad Engineering, Hydraulic Engineering, Bridge Engineering, etc. By International Correspondence Schools, Scranton, Pa. Scranton, Pa.: International Textbook Co. Cloth; 3¾ × 5½ ins.; pp. 330; numerous illustrations in the text. 50 cts.

METHODS FOR TESTING SHELLFISH FOR POLLUTION.—Stephen DeM. Gage. (Reprinted from "The Journal of Infectious Diseases," Vol. VII., No. 1, Jan. 15, 1910.) Paper; 6¾ × 9½ ins.; pp. 78 to 86.

THE MICHIGAN ENGINEER.—Containing the Proceedings of the Michigan Engineering Society for the Year 1909. Grand Rapids, Mich.: The Society (A. L. Holmes, Secy.). Cloth; 5½ × 9 ins.; pp. 268; plates and text illustrations.

THE MISTLETOE PEST IN THE SOUTHWEST.—By William L. Bray, Special Agent, Investigations in Forest Pathology. Bulletin No. 166, Bureau of Plant Industry; B. T. Galloway, Chief of Bureau. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.; pp. 39; two plates and seven text figures.

THE OCCLUDED GASES IN COAL.—By S. W. Parr and Perry Barker. Bulletin No. 32, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 28; two text illustrations.

POCKET MEMORANDA OF DIVIDENDS.—Paid by the Leading Railroad, Industrial, Mining and Miscellaneous Stocks in the U. S. during the Year 1909. New York: Arthur S. Leland & Co. (40 Exchange Place). Paper; 5¼ × 3¼ ins.; pp. 44. Sent on receipt of two-cent stamp.

PUBLIC SERVICE COMMISSION FOR THE FIRST DISTRICT OF THE STATE OF NEW YORK.—Report for the Year Ending Dec. 31, 1908. In three volumes. (William R. Willcox, Chairman.) Albany, N. Y.: Pub. Doc. Cloth; 5½ × 9 ins.
Vol. I.: Report and Appendices A to F, inclusive. Pp. 650; 3 folding sheets; 25 folding diagrams in separate envelope.
Vol. II.: Orders, Opinions and Reports. Pp. 785.
Vol. III.: Statistics of Public Service Corporations Compiled by the Bureau of Statistics and Accounts. Pp. 694; 4 folding diagrams.

RAILROAD COMMISSIONERS (Connecticut).—Annual Report, 1909, to Which are Added Statistical Tables Compiled from the Annual Reports of the Steam Railroad Companies of the State for the Year Ending June 30, and of the Street Railway Companies for the Same Period. (William O. Seymour, Chairman Commissioners.) Hartford, Conn.: Pub. Doc. (No. 12). Cloth; 5¾ × 9 ins.; pp. 491 + 176; two maps in pockets.

RECEIPTS AND EXPENDITURES OF ORDINARY REVENUE.—With Appendix Showing All Classes of Receipts and Expenditures, by Groups, 1904-1908. Special Publications No. 16, Statistics Department, City of Boston. Boston, Mass.: Pub. Doc. Paper; 9 × 11¾ ins.; pp. 165; one folding sheet.

REFUSE DISPOSAL BY HIGH TEMPERATURE DESTRUCTOR SYSTEM.—By William F. Morse, Sanitary Engineer. (Paper Read at the 1909 Convention of the American Society of Municipal Improvements; Abstract by permission from Proceedings of the Society.) Paper; 6 × 8¾ ins.; pp. 15; illustrated.

REPORT OF THE HUDSON'S BAY RAILWAY SURVEYS.—Department of Railways and Canals (Canada); M. J. Butler, Deputy Minister and Chief Engineer. Ottawa, Can.: Pub. Doc. (No. 20d—1910). Paper; 6½ × 10 ins.; pp. 22; 11 plates; 5 maps in separate envelope.

REPORT RELATING TO THE REGISTRATION OF BIRTHS, MARRIAGES AND DEATHS.—In the Province of Ontario for the Year Ending 31st December, 1907. (W. J. Hanna, Registrar-General.) Toronto, Ont.: Pub. Doc. Paper; 6¼ × 9½ ins.; pp. 44 + ccxl.

SOME ASPECTS OF IRRIGATION DEVELOPMENT IN COLORADO.—By George G. Anderson. (Proceedings of the Colorado Scientific Society, Vol. IX.) Denver, Colo.: The Society. Paper; 6 × 9½ ins.; pp. 273 to 314.

STATISTICAL RECORD OF THE PROGRESS OF THE UNITED STATES, 1800-1908.—And Monetary, Commercial and Financial Statistics of Principal Countries. From Statistical Abstract of the United States, 1908, Bureau of Statistics; O. P. Austin, Chief of Bureau. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 72.

SYDNEY UNIVERSITY ENGINEERING SOCIETY, NEW SOUTH WALES.—Journal and Abstract of Proceedings for 1908-9 Session. Vol. XIII. Edited by W. E. Cook, M. Inst. C. E., and E. W. Nardin. Sydney, Australia: The Society. Paper; 6 × 9¼ ins.; pp. 155; text illustrations.

TESTS OF TUNGSTEN LAMPS.—By T. H. Amrine and A. Guell. Bulletin No. 33, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 33; 28 illustrations in the text.

TEXT-BOOK ON HYDRAULICS.—By George E. Russell, Assistant Professor of Civil Engineering, Massachusetts Institute of Technology. New York: Henry Holt & Co. Cloth; 6 × 9½ ins.; pp. 183; 124 illustrations in the text. $2.50.

THE TRAVELING ENGINEERS' ASSOCIATION.—Proceedings of the Annual Convention Held at Denver, Colo., Sept. 7-9, 1909. Edited by W. O. Thompson, Secy., Buffalo, N. Y. Flexible leather; 5¾ × 8¾ ins.; pp. 373; folding plates and text illustrations.

ZEITUNGS-KATALOG DER ANNONCEN-EXPEDITION RUDOLF MOSSE, 1910.—43d edition. Hamburg, Germany: Rudolf Mosse. Cloth; 8 × 11¾ ins.; pp. xxxii. + 274 + 400; illustrated appendix, 80 pages, in separate cloth binding.

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